PROCEEDINGS

OF

THE ROYAL SOCIETY.

1831–1832. No. 10.

May 3, 1832. (Continued.)

JOHN BOSTOCK, M.D., Vice President, in the Chair.

A Paper was read, entitled, "An Account of certain new Facts and Observations on the Production of Steam," by Jacob Perkins, Esq. Communicated by Ralph Watson, Esq. F.R.S.

Having observed that water on the surface of melted iron was very slowly affected by the heat, although it exploded violently when the same fused metal was dropped into it, the author made a series of experiments on the time required for the evaporation of the same quantity of water successively poured into a massive iron cup, at first raised to a white heat, and then gradually cooled by the addition and evaporation of the water. The first measures of water were longer in being evaporated than those subsequently added, in consequence of the reduction in the temperature of the iron, until this temperature reached what the author calls the *evaporating point*, when the water was suddenly thrown off in a dense cloud of steam. Below this temperature, the time required for the complete evaporation of the same measure of water became longer in proportion as the iron was cooler, until it fell below the boiling point. The author accounts for these results from the circumstance that when the metal is at the higher temperatures, the water placed on its surface is removed from contact with it by a stratum of interposed steam. From these and other experiments, he is led to infer the necessity of keeping water in close and constant contact with the heated metal in which it is contained, in order to obtain from it, in the shortest time, the greatest quantity of steam.

The reading of a Paper, entitled, "On certain Irregularities in the Magnetic Needle, produced by partial warmth, and the relations which appear to subsist between terrestrial Magnetism and the geological Structure and thermo-electrical Currents of the Earth," by Robert Were Fox, Esq.—communicated by Davies Gilbert, Esq. V.P.R.S.—was commenced.

May 10, 1832.

JOHN WILLIAM LUBBOCK, Esq. M.A., V.P. and Treasurer, in the Chair.

The reading of Mr. Fox's Paper was resumed and concluded.

The author begins by an account of some experiments which he instituted with a view to discover the cause of the irregularities in the indications of the intensity of terrestrial magnetism given by the vibrating magnetic needle. By inclosing the needle in a box surrounded with water at different temperatures, the number of the vibrations did not appear to be affected by these differences of temperature when the heat was applied equally on all sides; but when partially applied, irregular oscillations took place, apparently from the currents of air set in motion by the inequalities of its temperature. Hence the author recommends that for delicate experiments the magnetic needle should be contained in a box of wood, or other imperfect conductor of heat; or, for still greater security, that it should be adjusted in a glass vessel exhausted of air. For experiments on magnetic intensity at sea, he recommends placing two magnets at some distance from the needle, in the line of its magnetic meridian, and surrounded with water, in order to preserve a uniformity of temperature. For increasing the action of terrestrial magnetism, he suggests the employment of a bar or cylinder of wrought iron, placed perpendicularly, or in the line of the dip, at right angles to the meridian, so as to repel the north pole of the needle: and also surrounded with water.

The experiments made with an apparatus of this kind in some of the deep mines in Conwall, did not lead to the conclusion that there is any increase of magnetic intensity at the depth of 1000 or 1200 feet below the level of the sea; but if any thing, rather the reverse; but, on the whole, the discrepancy in the results was so great, that no dependence can be placed on them as establishing a general fact of this importance.

It appeared also to the author that the direction of electrical currents under the earth's surface is greatly diversified; although, when taken collectively, the probability is that the tendency of the positive currents is from east to west.

The author then proceeds to state the results of his experiments on the thermo-electricity of rocks. He found that compact slate was an excellent conductor of electricity; and that the heated end gave indications of positive electricity. Granite, on the contrary, at a bright red heat, was almost incapable of conducting electricity, but when vitrified became nearly a perfect conductor, owing probably to the destruction of its crystalline structure. In general the end most heated was negative, and the same was the case with porphyritic feldspar. Greenstone and serpentine, which also occur in frequent alternations in Cornwall, in like manner differ in their electrical properties; the former giving out positive, and the latter negative electricity at their most heated parts. Many anomalies, however, occurred in these properties, the results being frequently reversed without any obvious cause.

On the hypothesis of the existence of a very elevated temperature in the interior of the globe, it would necessarily follow from the preceding experiments that electrical currents would be produced from this cause, taking frequently different, and even opposite di-

rections, and exerting an important influence on all the phenomena of terrestrial magnetism, both such as are general, and also such as appear to be local anomalies. The later researches of the author have satisfied him that the directions of these currents are probably much influenced by the geological structure of the globe; which would in most cases tend to give them more or less obliquity to the parallels of latitude. The author ascribes the diurnal changes in the direction and intensity of terrestrial magnetism to the successive action of the sun on the different portions of the surface of the globe. With reference to the causes that have determined the juxtaposition and arrangement of rocks in the interior of the earth, the author examines their comparative expansibility by heat. Granite, porphyritic feldspar, and clay-slate expanded from one-50th to one-77th by a red heat; while the expansion of serpentine, by the same heat, could not be rendered sensible. He concludes by calling in question the theory which ascribes the spheroidal form of the earth to its having been once a mass of plastic matter in igneous fusion or in aqueous solution.

May 17, 1832.

The Rev. WILLIAM BUCKLAND, D.D., Vice President, in the Chair.

The reading of a Paper, entitled, "On Harriot's Astronomical Observations contained in his unpublished Manuscripts belonging to the Earl of Egremont," by Stephen Peter Rigaud, Esq. M.A. F.R.S. Savilian Professor of Astronomy in the University of Oxford,—was commenced.

May 24, 1832.

DAVIES GILBERT, Esq. D.C.L., Vice President, in the Chair.

The reading of Professor Rigaud's Paper was resumed and concluded.

In the Memoirs of the Royal and Imperial Academy of Brussels, for the year 1788, the Baron de Zach published a paper on the planet Uranus, in a note to which he states that, in the summer of 1784, he found in the library of Lord Egremont at Petworth, some old manuscripts of the celebrated Thomas Harriot, which he alleges afforded proofs that he had observed the solar spots, and the satellites of Jupiter before Galileo. In the Berlin Ephemeris for 1788, Baron Zach gave a full account of his alleged discovery, drawn up from Harriot's papers; an English translation of which was circulated in this country, and has been perpetuated by its being inserted in Dr. Hutton's Mathematical Dictionary. The author, having been entrusted by Lord Egremont with Harriot's original papers, has examined them with every attention he could apply to the subject, and gives in the present memoir the result of his inquiry.

The observations of Harriot on the spots on the sun, fill seventy-four half-sheets of foolscap, the first being dated December 8, 1610.

These papers are in good preservation: the writing is clear, and the drawings well-defined. Baron Zach says, that "he compared the corresponding ones with those observed by Galileo, and found betwixt them an exact agreement." This, the author shows, is very far from being the case, and he also brings evidence to prove that the discovery of the spots on the sun was made by Galileo at latest in the summer of the year 1610, and very probably in or before the month of July. He allows, however, that Harriot's observation in December of the same year, was the result of his own spontaneous curiosity.

The first observation made by Harriot of the satellites of Jupiter, has for date the 17th of October 1610. Those that follow, extend to the 26th of February 1612: they are clearly written out on thirteen half-sheets of foolscap. But, even by the statement of Baron Zach, Galileo discovered them on the 7th of January 1610; that is, nearly eight months before Harriot.

The author has detected many other material inaccuracies in the account given to the world by Baron Zach of Harriot's observations. He concludes, however, by observing that Harriot ought not to be deprived of the credit which is justly due to him, because a greater share has by some persons been claimed for him than he is justly entitled to. He himself made no pretensions to priority in the discoveries in question.

May 31, 1832.

DAVIES GILBERT, Esq. D.C.L., Vice President, in the Chair.

The reading of a Paper, entitled, "On the Correction of a Pendulum for the reduction to a vacuum, together with Remarks on some Anomalies observed in Pendulum Experiments," by Francis Baily, Esq. F.R.S.,—was commenced.

June 7, 1832.

HIS ROYAL HIGHNESS THE DUKE OF SUSSEX, K.G., President, in the Chair.

Lord Henry John Spencer Churchill; the Hon. George Charles Agar, M.A.; John Disney, Esq.; James Clark, M.D.; James Hope, M.D.; the Venerable George Glover, M.A.; Michael Thomas Sadler, Esq. M.P.; Lieut. William Samuel Stratford, R.N.; James David Forbes, Esq., and Howard Elphinstone, Esq. M.A., were elected Fellows of the Society. Baron Damoiseau of Paris, Professor de Blainville of Paris, Professor Carlini of Milan, Professor Cauchy of Paris, and Professor Tiedemann of Heidelberg, were elected Foreign Members of the Society.

The reading of Mr. Baily's Paper on the Pendulum, was resumed and concluded.

The author observes, that in all the experiments hitherto made with the pendulum, a very important correction, depending on the influence of the circumambient air, has been omitted; and that the phi-

losophical world is indebted to M. Bessel for having first drawn the attention of the public more immediately to this subject. For, although Newton evidently suspected that such an influence existed, and although the subject had been since fully discussed by the Chevalier du Buat, nearly 50 years ago, yet it does not appear that any of the distinguished individuals, employed by the different Governments in making experiments on the pendulum in more recent times, have had any notion that the effect of the air, on the moving body, was any other than that depending on its density; and consequently varying in amount according to the specific gravity of the metal of which the pendulum might be composed. But M. Bessel has shown that a quantity of air is also set in motion by the pendulum (varying according to its form and construction), and thus a *compound pendulum* is in all cases produced, the specific gravity of which will be much less than that of the metal itself. M. Bessel's principal experiments for establishing the accuracy of this principle, were made with two spheres, about two inches in diameter, differing from each other very considerably in specific gravity, one being of brass, and the other of ivory, and each suspended by a fine steel wire. The author of the present paper, however, pursued another and a very different course for obtaining the same end: namely, by swinging the same pendulum first in free air, and afterwards in a highly rarefied medium, nearly approaching to a vacuum. From the difference in the results, he deduces a factor (denoted by n), by which the old, and hitherto received, correction must be multiplied in order to obtain the new and more accurate correction indicated by M. Bessel; and which, in the case of the two spheres above mentioned, is found by that author to be equal to 1·95.

But Mr. Baily, instead of confining himself to spheres of this size, and composed of these two substances only, has extended his inquiries to pendulums of various magnitudes, substances and forms. His first recorded experiment is on Borda's platina sphere, the diameter of which is 1·44 inch; and he found that the old correction must in this case be multiplied by 1·88 in order to obtain the true and accurate correction; or, in other words, that the old correction was but little more than half what it ought to be. The author then tried three other spheres of precisely the same diameter, but differing considerably in specific gravity: namely, lead, brass, and ivory, all of which gave nearly the same result; the mean of the whole being $n=1·86$. He next proceeded to spheres of the size used by M. Bessel, made of three different substances, viz. lead, brass, and ivory. These gave a result (agreeing very well with each other,) somewhat smaller than the former; the mean of the whole being $n=1·75$: thus showing that the factor for the additional correction is due to the form and magnitude of the moving body, and not to its weight or specific gravity. This last value, as the author observes, differs from that deduced by M. Bessel as above mentioned; but the cause of the discordance does not appear.

The author then shows the effect produced on cylinders of various kinds, both solid and hollow, and suspended in different ways,—on

lenses, on cylindrical rods, on bars, on tubes, on convertible pendulums, and on several clock pendulums, amounting to upwards of 40 in number. The results of these experiments give in each case a different value for the factor n; and which appears to depend on the extent of surface, in proportion to the bulk of the body exposed to the direct action of the air when in motion: further experiments, however, are requisite to establish this point in a satisfactory manner*. But, in the author's opinion, enough is shown to indicate the necessity and propriety of a revision and correction of all the experiments hitherto made with the pendulum, either for the determination of its absolute length, or for ascertaining the true figure of the earth; and that for this purpose, the true correction must be found from actual experiment in each particular case; since, with very few exceptions, it cannot be determined by any mathematical deduction.

Mr. Baily then proceeds to point out some singular discordances arising from the knife-edge mode of suspending the pendulum, where the *same* knife-edge and the *same* agate planes are employed. From which he is led to infer that the pendulum furnished with a knife-edge and agate planes, as at present constructed, is a very inadequate instrument for the delicate purposes for which it was originally intended; and that a more rigid examination of that part of the instrument is requisite, before we can rely with confidence on the accuracy of the results obtained by it.

Some anomalies are then pointed out in the magnitude of the arc of vibration, and some remarks offered on the supposed inadequacy of the usual formula for determining the correction for the arc; but the author considers it desirable that further experiments should be made for the more accurate determination of this point.

In conclusion, the author expresses a doubt of the rigid accuracy of the length of the seconds pendulum, as deduced from the recent experiments of Captain Sabine.

To the whole are appended tables exhibiting the details of all the experiments made by the author, and the corresponding results.

A Paper was read, entitled, "Researches in Physical Astronomy," by John William Lubbock, Esq. V.P. and Treas. R.S.

The present paper contains some further developments of the theory of the moon, which are given at length, in order to save the trouble of the calculator, and to avoid the danger of mistake. The author remarks, that while it seems desirable, on the one hand, to introduce into the science of physical astronomy a greater degree of uniformity, by bringing to perfection a theory of the moon founded on the integration of the equations employed in the planetary theory, it

* Since this paper was read, the author has made a number of additional experiments on various other pendulums, which, by permission of the Council, will form part of the original paper; and from which he is led to infer that, in the case of spheres, cylinders, and other bodies suspended by rods of different diameters, the value of the factor depends not only on the body appended to such rod, but that the rod itself has a considerable influence on the result, except it be a very fine wire; when its effect becomes merged in that of the appended body.

is also no less important, on the other hand, to complete, in the latter, the method hitherto applied solely to the periodic inequalities. Hitherto those terms in the disturbing function which give rise to the secular inequalities, have been detached, and the stability of the system has been inferred by means of the integration of certain equations, which are linear when the higher powers of the eccentricities are neglected; and from considerations founded on the variation of the elliptic constants. But the author thinks that the stability of the system may be inferred also from the expressions which result at once from the direct integration of the differential equations. The theory, he states, may be extended, without any analytical difficulty, to any power of the disturbing force, or of the eccentricities, admitting the convergence of the series; nor does it seem to be limited by the circumstance of the planet's moving in the same direction.

A Paper was also read, entitled, "On the Nervous System of the *Sphinx Ligustri* (Linn.), and on the Changes which it undergoes during a part of the Metamorphoses of the Insect," by George Newport, Esq. Communicated by Peter Mark Roget, M.D., Sec. R.S.

The author gives a minute anatomical description, accompanied by drawings, of the development and arrangement of the nerves of the *Sphinx Ligustri*, and the successive changes they undergo during the last stage of the larva, and the earlier stages of the pupa state. As this insect, in passing from its larva to its perfect state, remains for several months in a torpid condition, it affords a better opportunity of minutely following these changes, and of ascertaining in what manner they are effected, than most other insects; and the great comparative size of this species renders the investigation still more easy.

While in its larva state, this insect frequently changes its skin: it enlarges rapidly in size after each operation, and the nervous system undergoes a corresponding development. The author minutely describes the longitudinal series of ganglia, which extend the whole length of the animal. He remarks that the eleventh or terminal ganglion is distinctly bilobate, a form which, as suggested to him by Dr. Grant, is probably acquired by the consolidation of two ganglia which had been separate at an earlier period of development. A detailed account is then given of the nerves proceeding from these several ganglia.

During the change from the state of larva to that of the perfect insect, the number of the ganglia is found to diminish in consequence of the approximation and conjunction of adjacent ganglia; and the nervous cords which connect them are generally much shortened. A nerve is described which, from the mode of its distribution to the stomach, intestinal canal, and dorsal vessel, presents a remarkable analogy to the *par vagum*, or pneumogastric nerve of vertebrated animals; so that the author considers it probable that its functions are somewhat similar to this nerve; as has, indeed, been already conjectured by Straus-Dürckheim. Another division of nerves exist, which, from the principal branches derived from each abdominal plexus being always distributed among the tracheæ, near the spiracles, are perhaps analogous to the sympathetic system of nerves of the higher classes of animals.

When on the point of becoming a pupa, the nervous lobes above the œsophagus are found to be considerably enlarged, and to have assumed more of the appearance of a cerebral mass; while, at the same time, the nervous cords descending from them are shortened and thickened. The ganglia are brought nearer together, and their intervening cords lie between them in an irregular manner, the ganglia themselves being retained in their proper places in the segments by the nerves running transversely from them. The nerves of the antennæ are enlarged, and the optic nerves are become much thicker and shorter than before. There is a remarkable enlargement of the thoracic nerves, particularly of those sent to the wings; and those belonging to the posterior pair of legs are curiously convoluted within the thorax, preparatory to their being uncoiled at the instant of the change being made to the pupa state.

These changes are followed minutely through several stages of development. The author expects to be able to lay before the Society, in a subsequent paper, the results of his investigation of the remaining stages, and to offer some observations upon the manner in which these changes are effected.

The Society then adjourned over Whitsun Week to the 21st of June.

June 21, 1832.

HIS ROYAL HIGHNESS THE DUKE OF SUSSEX, K.G., President, in the Chair.

Papers were read, bearing the following titles:

1. "An Account of the magnetical Experiments made on the Western Coast of Africa in 1830 and 1831," by Commander Edward Belcher of H.M.S. Etna. Communicated by the Rev. George Fisher, M.A. F.R.S., through Captain Beaufort, R.N. F.R.S.

The object of the inquiry specified in this paper, and of which the results are given in a tabular form, was to determine the relative horizontal intensities of terrestrial magnetism on the different parts of the coast of Africa which the author has been lately employed in surveying. The experiments were made with four needles constructed by Dollond on the model of those of Professor Hansteen; and the permanence of their magnetism during the voyage was verified by a comparison of trials made in England before and since the voyage. Errors arising from local causes of irregularity were guarded against by varying the places of observation at each station, and taking mean results.

2. "On the Use of a substance called the *False Tongue* in Foals," by Professor Sewell, of the Royal Veterinary College. Communicated by Sir Charles Bell, F.R.S.

The substance called the *false tongue*, which is thrown out from the mouth of the foal, either at the period of birth, or shortly before it, and to which various whimsical uses and virtues have been assigned, is conceived by the author to be requisite in this animal or the action of sucking, in consequence of its not respiring through

the mouth, but altogether through the nasal passages: an instinctive feeling prompting it to supply the loss of that substance by sucking the teat of the mother. Dr. Prout, who analysed a portion of this substance at the request of the author, finds it to be composed principally of coagulated albumen slightly modified. The author regards it as a secretion from the tongue of the foal.

3. "Journal of the Weather, kept at High Wycombe during the year 1831, with monthly Observations," by James G. Tatem, Esq. Communicated by William Allen, Esq. F.R.S.

These tables exhibit the greatest elevations and depressions of the barometer and thermometer for the year 1831, together with the means of the observations, which were made at 8 A.M., 3 P.M., and 10 P.M.; the extremes of cold being given by a self-registering thermometer. The quantity of rain was measured every morning at 8 o'clock. The course of the wind is noted, and remarks subjoined, showing the results of a comparison with former years.

4. "Physical and Geological observations on the Lake of Oo near Bagneres de la Chou, in the year 1831," by M. Nerée Boubée, Professor of Geology at Paris. Communicated by P. M. Roget, M.D., Sec. R.S.

The author ascertained that the bottom of the lake, which is 230 French feet in depth, forms a level plane of great extent, and is covered with a stratum of mud composed of fine micaceous sand of a blue colour. The temperature of the bottom of the lake was 7° of the centigrade scale, at the middle 9°, at the surface 11°; that of the air varying from 14° to 15°. There was no indication of any current on the surface. A cascade 954 feet in height falls into the lake, carrying down the detritus of the surrounding rocks.

5. "Observations on the anatomy and habits of Marine Testaceous Mollusca, illustrative of their mode of feeding," by Edward Osler, Esq. Communicated by L. W. Dillwyn, Esq. F.R.S.

The author observes that in studying the physiology of the Mollusca, more satisfactory results may generally be obtained by tracing the organization connected with each important function, through different families, than by complete dissections of individual species; and, by thus connecting the study of function with that of structure, the zoologist is led to more certain inferences relating to those habits, the knowledge of which the pelagic character of the animal, and the difficulty of direct observation, would otherwise have rendered unattainable. The present paper is devoted to the anatomical investigation of the organs by which the food is received into the bodies of certain Mollusca. The herbivorous Mollusca which the author has examined have three modes of feeding. Some, as the *Trochus crassus*, browse with opposite horizontal jaws: others, as the *Turbo littoreus*, rasp their food with an armed tongue stretched over an elastic and moveable support: while others again, as the *Patella vulgata*, gorge it entire. The author enters into a minute anatomical description of the organs of manducation and deglutition, and also of that part of the nervous system situated in the neighbourhood of these organs, in each of these respective Mollusca,—illustrated by numerous draw-

ings. He gives in each case a particular account of the mode of dissection, with a view to direct succeeding observers to obtain a distinct view of the parts he describes, and to verify the conclusions he has himself obtained.

He next notices a considerable modification in the structure of these organs which is presented in the Chiton. In this animal he finds a pair of simple lateral jaws, rather membranous than cartilaginous. Another variety of structure adapted for gorging food is met with in the *Patella mammillaris*, where there is simply a very muscular mouth and pharynx, but neither cartilage, tongue, nor hard part of any kind.

The apparatus by which the *Buccinum Lapillus* drills through shells in order to obtain its food, and the process it employs for that purpose, are next investigated; and that of the *Buccinum undatum* is particularly examined with the same view, the structure of the latter being very fully displayed.

The author hopes to be enabled to pursue these inquiries with respect to other tribes of Mollusca at some future period.

6. "On the Mammary Glands of the *Ornithorhynchus paradoxus*," by Richard Owen, Esq. Communicated by J. H. Green, Esq., F.R.S.

The author premises a history of the different opinions that have been entertained with respect to the anatomy and economy of this singular animal, which was first described and figured by Dr. Shaw in the year 1792. The name of Ornithorhynchus, which it at present bears, was given to it by Blumenbach; and some account of the structure of the head and beak was given in the Philosophical Transactions by Sir Everard Home in 1800; and in a subsequent paper he states his opinion that this animal differs considerably from the true mammalia in its mode of generation, an opinion which was adopted by Professor Geoffroy St. Hilaire, who accordingly placed it, together with the Echidna, in a separate order designated by the term *Monotrèmes*. He afterwards formed this group into a distinct class of animals, intermediate to mammalia, birds, and reptiles. Oken and De Blainville, on the other hand, condemned this separation; and maintained that the monotremata should be ranked among mammalia, and as being closely allied to the marsupialia; and hazarded the conjecture that they possessed mammary glands, which they expected would ere long be discovered. Professor Meckel has since described these glands as being largely developed in the female Ornithorhynchus. He considers this animal, however, in the mode of its generation, as making a still nearer approach to birds and reptiles, than the marsupial tribe. He was unable to inject these glands in consequence of the contracted state of the ducts arising from the action of the spirit in which the specimen was preserved, and from their being filled with a concrete matter. Geoffroy St. Hilaire, in a subsequent memoir, persists in denying that these bodies possess the characters of mammary glands; but regards them as a collection, not of acini, but of cæca, having only two excretory orifices, and presenting no trace of nipples.

The author of the present memoir, having examined with great

care the specimens of the female Ornithorhynchus preserved in the Museum of the Royal College of Surgeons, found the structure to correspond very exactly with the account given by Meckel; and, moreover, succeeded in injecting the ducts of these glands with mercury. He further notices the differences of development occurring in five different specimens: the size of these glands having an obvious and direct relation to that of the ovaria and uteri. The gland itself is composed of from 150 to 200 elongated subcylindrical lobes, disposed in an oblong flattened mass, converging to a small oval areola in the abdominal integument, situated between three and four inches from the cloaca, and about one inch from the mesial line. It is situated on the interior of the panniculus carnosus, the fibres of which separate for the passage of the ducts to the areola; the orifices of these ducts are all of equal size, and occupy an oval space five lines in length by three in breadth; not elevated however in the slightest degree above the surrounding integument. An oily fluid may be expressed from the ducts by squeezing the gland.

A minute description is then given of the anatomical structure of the internal genito-urinary organs of the female Ornithorhynchus: from which it appears that if the animal be oviparous, its eggs must, from the narrow space through which they have to pass in order to get out of the pelvis, be smaller than those of a sparrow; and no provision appears to be made for the addition of albumen or of shell in the structure of that part of the canal through which they afterwards descend previous to their expulsion from the body. The ova are enveloped in a tough fibrous membrane in which the traces of vascularity, at least after being preserved in spirits, are not perceptible; whilst in birds the ova are attached by narrow pedicles, and are covered by a thin and highly vascular membrane.

From the whole of this inquiry, the author concludes that these glands are not adapted to the performance of any constant office in the economy of the individual, but relate to a temporary function. Their total absence, or at least their rudimentary condition, in the male, of which the author could perceive some traces in one specimen which he examined, and the greater analogy of their structure to a lacteal apparatus than to that of ordinary odoriferous glands, when taken in conjunction with the correspondence of their development to that of the uterine system, induce him to believe that they are to be regarded as real mammæ. This view is confirmed by the fact, noticed by Mr. Allan Cunningham, that the young of this animal readily takes cow's milk, and may be kept alive by this kind of sustenance.

7. "A Physiological Inquiry into the Uses of the Thymus Gland," by John Tuson, Esq. Communicated by J. C. Carpue, Esq., F.R.S.

The author is of opinion that the thymus gland is intended for two purposes: the one to serve as a receptacle of blood for supplying the chasm in the circulation occasioned by the great quantity sent to the lungs as soon as the function of respiration commences: the other to serve as a receptacle of osseous matter preparatory to the extensive ossification which is carried on in the early periods of growth.

8. "An Investigation of the Powers of the simple Supporters of Combustion to destroy the virulence of Morbid Poisons, and of the poisonous Gases, with a view to ascertain the possibility of controuling the extension of contagious or epidemic Diseases," by Edward Browne, Esq. F.L.S. Communicated by J. H. Green, Esq. F.R.S.

The author, after giving an account of the diversity of opinions entertained with regard to the power of chlorine gas to destroy contagion, states that this gas exerts a similar disinfecting power on the virus of small-pox, and mentions the result of some experiments he tried on gonorrheal matter, on which it appeared to effect a similar change. Various experiments are stated to have been made with iodine and with oxygen, indicating the same disinfecting agency in these substances. The author conceives that these effects are promoted by the heat communicated to the respired air in the lungs. He conceives that sea air possesses a disinfecting power, which he explains by supposing that it contains a portion of iodine. He conjectures, from analogy, that fluorine and bromine may have the same property.

9. "Considerations on the Laws of Life, in reference to the Origin of Disease," by Adair Crawford, M.D. Communicated by T. J. Pettigrew, Esq. F.R.S.

The scope of this paper is to show the insufficiency of all theories which attempt to account for the phenomena of the living body, either in health or disease, by an exclusive reference either to the solids or to the fluids which enter into its composition; or to the influence of an abstract and unknown principle of life; or to that of physical or chemical agents; or to the functions of the nervous, or of the vascular systems. For the establishment of the sciences of physiology and pathology upon the most solid foundations, the author is of opinion that all the circumstances above mentioned should be duly taken into account, and allowed their respective and proportionate degree of influence.

10. "On the Water Barometer erected in the Hall of the Royal Society," by J. F. Daniell, Esq. F.R.S. Professor of Chemistry in King's College, London.

The author having long considered that a good series of observations with a water barometer would be of great value as throwing light upon the theory of atmospheric tides, of the horary and other periodic oscillations of the barometer, and of the tension of vapour at different temperatures, was desirous of learning whether any such series of observations had ever been made. But he could meet with none having any pretensions to accuracy; for neither those of Otto Guericke, in whose hands the water barometer was merely a philosophical toy, nor the cursory notices of the experiments of Mariotte upon this subject contained in the History of the French Academy of Sciences, can be considered as having any such claim. The difficulties which opposed the construction of a perfect instrument of this kind long appeared to be insurmountable; but the author at length proposed a plan for this purpose, which, having been approved of by the late Meteorological Committee of the Royal Society, was ordered by the President and Council to be carried into execution.

The author then enters fully into the details of the methods he employed for constructing the whole of the apparatus, and for placing it in its present situation in the centre of the winding staircase conducting to the apartments of the Royal Society. The tube was very skilfully made by Messrs. Pellatt and Co. at the Falcon Glass-house. It was 40 feet long, and one inch in diameter at its lower end; and so nearly cylindrical, throughout its whole extent, as to diminish only by two tenths of an inch at its upper end. A second tube of the same dimensions was also made as a provision in reserve against any accident happening to the first. These tubes were both securely lodged in a square case by means of proper supports. A small thermometer with a platina scale, was introduced into the upper end of the tube. An external collar of glass was united to that end by heating it. This was done with a view of giving it additional support, and of preventing it from slipping. This end of the tube was then drawn out into a fine tube ready for sealing with the blowpipe; and a small stopcock was fitted on to it. The cistern of the barometer was formed by a small copper steam boiler, 18 inches long, 11 wide, and 10 deep, capable of being closed by a cock, and having at the bottom a small receptacle for holding the lower end of the tube, so as to allow of the water in the cistern being withdrawn, without disturbing that contained in the tube.

The boiler was set with brickwork, in a proper position, over a small fire-place. It was nearly filled with distilled water, which was made to boil thoroughly so as to free it from air; and the cock being then closed, the water was raised in the tube by the pressure of the steam collected in the upper part of the cistern. The tube, when filled, was hermetically closed at the top: a proper scale, constructed by Newman, was applied to it, great care being taken to determine its height and to ensure the accuracy of its adjustments, and the precision of its measurements, by an exact mode of reading; and also to provide proper corrections for temperature. The water in the cistern was protected from contact with the air by being covered with pure castor oil to the depth of half an inch. The mercurial barometer employed as a standard of comparison, was of a portable construction, and was provided with a platina guard.

An account is then given of some of the results of the observations made with this water barometer, arranged in several sets of tables. The great object was to obtain good and uninterrupted series of observations, taken, at least once a day, at a fixed hour. The registers given by the author, contain such observations, continued for nearly a year and a half, namely, from October 1830 to March 1832. Some curious results are afforded by these observations. In windy weather the column of water is found to be in perpetual motion, not unlike that from the breathing of an animal. Many considerable fluctuations in the pressure of the atmosphere are rendered sensible by the motions of an aqueous column, which would totally escape detection by the ordinary mercurial barometer. Mr. Hudson remarked in the course of his observations, that the rise and fall of the water barometer precedes by one hour the similar motions of the

mercurial one. The most striking result of the comparison between the two, is the very near coincidence of the elasticity of the aqueous vapour, as deduced from the experiments, with its amount, as determined from calculation, in a range of temperature from 58° to 74°. But a gradually increasing difference was at length perceptible, showing that gaseous matter had by some means insinuated itself into the tube. When this became no longer doubtful, the boiler was opened, and it was found that a portion of the liquid oil had escaped; and that the remainder had become covered with large flakes of a mucilaginous substance, by means of which it is probable that a communication had been established between the air and the water. The water had, however, retained its purity, and no indication was afforded of the metal having been anywhere acted upon. The author recommends that if these researches are prosecuted, the water should be covered with a stratum of oil of four or five inches in depth, which he has reason to think will form an effectual barrier to all atmospheric influence.

11. "Hourly Observations on the Barometer, with experimental investigations into the phenomena of its periodical oscillation," by James Hudson, Assistant Secretary and Librarian to the Royal Society. Communicated by J. W. Lubbock, Esq. M.A., V.P. and Treas. R.S.

Mr. Lubbock having found, from his examination of the meteorological observations made daily at the Royal Society, that they afforded no satisfactory result as to the daily variation of the barometer in consequence of the too great length of the intervals between the times of observation, the author undertook the task of making a series of hourly observations for a period sufficiently extensive to furnish preliminary data for explaining the anomalies of the barometrical oscillations. The present paper contains these hourly observations, amounting to about 3000 in number, and made in the months of April, May, June, and July, 1831, and in those of January and February of 1832. The standard barometer of the Society has been observed for about 16 or 18 hours during the day, through a period of 75 days; and also at every hour, through the whole twenty-four hours, for 30 days: the water barometer every hour, day and night, for 15 days; and the mountain barometer also every hour, day and night, for the same period. The relative levels of the surfaces of the fluids in the cisterns of each of these barometers, were accurately determined by Mr. Bevan. The most striking results afforded by these observations are exhibited by means of linear representations in four drawings which accompany the paper. The respective variations from each general mean, being referred, according to a given scale, to the mean line, and their points of distance from it, at each successive hour, being connected together by straight lines, the barometrical and thermometrical changes being each referred to the same scale, exhibits the striking connexion that exists between them. The comparison of the simultaneous movements of the three barometers shows the general accordance of their mean variations; and the precession in time, by about an hour, of the mean motions of the water barometer over those of the stand-

ard barometer; and also the precession, by the same interval, of the mean changes of this latter instrument over those of the mountain barometer. The author concludes by announcing many objects he has in view in the investigations in which he is at present engaged.

12. "Note on the Tides in the Port of London," by J. W. Lubbock, Esq., V.P. and Treas. R.S.

The author gives a comparative view of the predicted times of high water deduced from Mr. Bulpit's tables, White's Ephemeris, and the British Almanac, with the observations at the London Docks, from data furnished to him by Mr. Stratford; and also a comparison, by Mr. Deacon, at the London and St. Katherine's Docks.

13. "Researches in Physical Astronomy," by the same.

In this Paper a method is given of developing the disturbing function, in which the coefficients of the inequalities corresponding to any given order, are expressed in terms of the coefficients of the inferior orders; so that, for example, the coefficients of the terms in the disturbing function, multiplied by the squares of the eccentricities, are given analytically by means of the coefficients of those independent of the eccentricities, and of those multiplied by their first powers. As the theorems, to which this method gives rise, are of great simplicity, the author considers them as deserving attention.

The Society then adjourned over the Long Vacation, to the 15th of November.